Site: Apples	**Overall Confidence Rating: High**

Background: A total of 641,000 acres are planted in apples in the United states. Organophosphate pesticides (OP) represent 68% of all pesticide usage on this crop with an average of 2.82 applications per year. Analysis of OP usage was conducted for the following five major apple regions: New England (CT, MA, ME, RI, NH, NJ, NY, VT) , North Central (MI and OH), Appalachian-Southern (DE, GA, MD, NC, PA, SC, TN, VA, WV), Western (AZ and CA), and Pacific North. (OR and WA). Insecticide use patterns and key pests vary both between and within regions. In the absence of effective controls, key pests can destroy 50-90% of the crop. Due to low damage threshold levels in apples, biological control is limited to indirect pests (non-fruit feeding) with little contribution against direct pests.

Organophosphate	% Treated		# Applications		Rate (lb AI/A)		PHI (days)	
Pesticides	Max[23]	Avg[23]	Max[21]	Avg[2-11]	Max[21]	Avg[2-11]	Min[21]	Avg
azinphos-methyl	64.7	61.4	4	2.1	3.1	0.8	7	
chlorpyrifos	53	44	NS	1.6	4	1.4	30	
diazinon	6	3	NS	1.6	5	1.2	21	
dimethoate	14.9	7.4	NS	1.3	2.0	0.8	28	
malathion	15	10	NS	1.1	2.3	0.8	21	
methyl parathion	25	18	NS	1.0	2	2.0	21	
phosmet	34	22	NS	2.9	4	1.1	7	

Confidence Rating: H= high confidence = data from several confirming sources; confirmed by personal experience
M = medium confidence = data from only a few sources; may be some conflicting or unconfirmed info.
L = low confidence = data from only one unconfirmed source

Organophosphate Target Pests for Apple in New England Region (Primary pests controlled by the OP's)[6, 9, 17, 18]	
Major	Bug (Tarnished Plant), Aphids (Rosy Apple, Apple, and Spirea), Apple Maggot, Plum Curculio
Moderate	Leafroller (Obliquebanded and Redbanded))
Minor	Fruitworm (Green and Sparganothis), Sawfly (European Apple), Leafhopper (White Apple and Potato), Scale (San Jose), Mite (European Red), Leafminer (Spotted Tentiform)

Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor =<5% of all OP usage on pest

Organophosphate Target Pests for Apple in North Central Region (Primary pests controlled by the OP's)[7, 10, 16]	
Major	Codling Moth, Apple Maggot
Moderate	Aphid (Green Apple and Rosy Apple), Fruitworm (Green), Leafroller (Fruit Tree, Red Banded, Oblique Banded, and Variegated), Scale (San Jose), Plum Curculio,
Minor	Mites (European Red, Rust, and Two Spotted Spider), Fruit/Bud Moth (Oriental Fruit, Tufted Apple Bud, and Eye-Spotted Bud), Leafminer (), Bug (Tarnished Plant and Stink), Leafhopper (White Apple and Potato), Borer (Dogwood)

Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor =<5% of all OP usage on pest

Organophosphate Target Pests for Apple in Appalachian-Southern Region (Primary pests controlled by the OP's)[3, 4 ,14, 15]	
Major	Aphid (Rosy Apple, Apple, Spirea and Apple Grain), Codling Moth
Moderate	Leafroller (Red Banded and Oblique Banded), Scale (San Jose), Mites (European Red, Twospotted Spider, and Apple Rust), Bug (Tarnished Plant and Mullein Plant), Leafhopper (White Apple, Rose, and Potato)
Minor	Fruit/Bud Moth (Tufted Apple Bud and Oriental Fruit), Leafminer (Spotted Tentiform), Plum Curculio, Apple Maggot, Fruitworm (Green)

Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor =<5% of all OP usage on pest

Organophosphate Target Pests for Apple in Western Region (Primary pests controlled by the OP's)[8, 19, 20]	
Major	Aphid (Rosy Apple, Green Apple, and Green Peach), Codling Moth
Moderate	Scale (San Jose, Italian Pear, and Grape Mealybug)
Minor	Mites (European Red, Apple Rust, Pacific Spider, and McDaniel Spider), Borer (Pacific Flatheaded)

Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor =<5% of all OP usage on pest

Organophosphate Target Pests for Apple in Pacific North Region (Primary pests controlled by the OP's)[2, 11, 12, 13]	
Major	Leafrollers (Pandemis, Oblique Banded, Fruittree, and European), Codling Moth
Moderate	Scale (San Jose and Oystershell), Fruitworm (Green, Speckled Green, and Pyamidal), Apple Maggot, Aphid (Green Apple, Rosy Apple, and Apple Grain), Mites (European Red, Apple Rust, Twospotted Spider, and McDaniel Spider)
Minor	

Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor =<5% of all OP usage on pest

Sources:

1. Proprietary EPA market share information.
2. U.S. Apple QUA+ - Washington. 1997.
3. U.S. Apple QUA+ - Virginia, West Virginia. 1997.
4. U.S. Apple QUA+ - Georgia, North Carolina, South Carolina and Tennessee. 1997.
5. U.S. Apple QUA+ - Pennsylvania. 1997.
6. U.S. Apple QUA+ - New England. 1997.
7. U.S. Apple QUA+ - Michigan. 1997.
8. U.S. Apple QUA+ - California. 1997.
9. QUA+ - New England Fruit Consultants.
10. QUA+ Michigan Apple Commission. 1997
11. QUA+ - Northwest Horticultural Council. 1997.
12. Orchard Pest Management; A Resource Book for the Pacific Northwest.1993. Good Fruit Grower, Yakima, WA.
13. Pacific Northwest 1998 Insect Control Handbook. 1998. Oregon State University.
14. 1997 Spray Bulletin for Commercial Tree Fruit Growers. Virginia, West Virginia and Maryland Cooperative Extension.
15. Pennsylvania Tree Fruit Production Guide. 1996-1997. College of Agricultural Science, Penn State University.
16. 1997 Fruit Spraying Calendar for Commercial Fruit Growers. 1997. Bulletin E-154. Michigan State University Extension.
17. Pest Management Recommendations for Commercial Tree Fruit Production. 1997. Cornell University.
18. 1996-1997 New England Apple Pest Management Guide. Cooperative Extension (Universities. of Connecticut, New Hampshire, Maine, Rhode Island, Massachusetts and Vermont)
19. Apple Pest Management Guidelines. 1996. UCPMG Publication 12. IPM Education and Publications, Univ.- CA, Davis.
20. Integrated Pest Management for Apples and Pears. 1991. Publication 3340. University of California.
21. Label Use Information System (LUIS) Version 5.0, EPA.
22. The All-Crop, Quick Reference Insect Control Guide (1997), Meister Publishing Company
23. EPA Crop Profile QUA.

Date: 01/28/99

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Pre-Bloom									
Aphid (Rosy Apple, Green Peach, and Spirea, does not include Wooly) (Moderate)	azinphos-methyl	---	Lo		C	methomyl	❍	Mod	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. Mite outbreaks would entail more miticide applications with potential for resistance. **Esfenvalerate** and endosulfan do not provide adequate efficacy against aphids. **Imidicloprid** resistance can be expected without other effective OP alternatives. **Oil** efficacy is dependent upon suitable weather conditions and may cause phytotoxicity at temperatures below 40°F.
	chlorpyrifos	● - ☺	High		C	oxamyl	❍	Lo	
	dimethoate	● - ☺	Lo		P	esfenvalerate	●	---	
	methyl parathion	● - ☺	---		P	permethrin	●	---	
					CH	endosulfan	●	High	
					O	imidacloprid	☺	---	
					O	petroleum oil	● - ☺	---	
Fruitworm (Moderate)	azinphos-methyl	---	Mod		C	methomyl	❍	---	**Pyrethroids** may flare many pests by killing predators and beneficials. Pyrethroid use against Fruitworm would lead to increased miticide applications with potential for development of resistance.
	chlorpyrifos	☺	Mod		P	esfenvalerate	☺	Lo	
	diazinon	●	---		P	permethrin	☺	High	
	methyl parathion	●	---						
	phosmet	---	High						
Leafroller (Moderate)	azinphos-methyl	☺	High		C	carbaryl	●	---	Indications of leafroller resistance to **methomyl**. **Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance (already noted for esfenvalerate).. **Bacillus thuringiensis** efficacy is temperature dependent and requires multiple applications.
	chlorpyrifos	☺	Mod		C	methomyl	☺	---	
	diazinon	❍	---		P	esfenvalerate	☺	Mod	
	dimethoate	● - ☺	High		P	permethrin	☺	High	
	methyl parathion	☺	---		O	Bacillus thuringiensis	---	---	
	phosmet	☺	Mod						

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Pre-Bloom									
Scale (Moderate)	chlorpyrifos	☺	High		O	petroleum oil	☺	High	**Oil** efficacy is dependent upon suitable weather conditions and may cause phytotoxicity at temperatures below 40°F.
	diazinon	❍	---						
	dimethoate	---	Mod						
	methyl parathion	❍	---						
Mites (Minor)	azinphos-methyl	---	Mod		C	carbaryl	❍	Lo	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance. **Oil** efficacy is dependent upon suitable weather conditions and may cause phytotoxicity at temperatures below 40°F.
	phosmet	---	Low		C	methomyl	❍	Lo	
					C	oxamyl	● - ❍	Lo	
					P	esfenvalerate	---	Lo	
					P	permethrin	---	Lo	
					CH	endosulfan	☺	---	
					O	chinomethionate	---	Lo	
					O	clofentezine	● - ☺	High	
					O	formetanate hydrochloride	☺	Lo	
					O	hexythiazox	☺	Mod	
					O	petroleum oil	☺	High	
					O	propargite	---	Lo	
Fruit/Bud Moth (Minor)	azinphos-methyl	---	High		C	carbaryl	---	Lo	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance. **Pheromones** are commercially unproven.
	chlorpyrifos	---	Lo		P	esfenvalerate	---	Lo	
	methyl partathion	---	Lo		P	permethrin	---	Lo	
	phosmet	---	High		O	pheromone	---	---	

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Pre-Bloom									
Leafminer (Minor)	azinphos-methyl	---	Mod		C	methomyl	❍ - ☺	Mod	Control efficacy is dependent upon life stage being exposed. Efficacy of alternatives varies in relation to target species and area.
	chlorpyrifos	---	Mod		C	oxamyl	☺	---	
	dimethoate	●	---		P	esfenvalerate	● - ☺	High	
					P	permethrin	● - ☺	High	
					CH	endosulfan	●	Mod	
					O	formentate hydro.	❍	---	
					O	imidicloprid	☺	Lo	

ADDITIONAL INFORMATION:

Apple production in the North Central Region (Michigan and Ohio) accounts for 13.6% of total acreage and 7.9% of production for the US. OP usage during the Pre-Bloom period in the North Central Region is 46.7% of all pesticide usage.

For secondary and indirect pests there are no alternative chemical controls available at this time.

SOURCES:

1. Proprietary EPA market share information.
2. U.S. Apple QUA+ - Michigan. 1997.
3. QUA+ Michigan Apple Commission. 1997
4. 1997 Fruit Spraying Calendar for Commercial Fruit Growers. 1997. Bulletin E-154. Michigan State University Extension.
5. The All-Crop, Quick Reference Insect Control Guide. 1997. Meister Publishing Company.
6. Label Use Information System (LUIS) Version 5.0, EPA.

Date: 01/28/99

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Post-Bloom									
Codling Moth (Major)	azinphos-methyl	☺	High		C	carbaryl	☺	Lo	**Pyrethroids** may flare many pests by killing predators and beneficials. Pyrethroid use would lead to more miticide applications and development of resistance. **Pheromone** disruption of mating is a weak alternative for controlling Codling Moth but would still require pesticide application.
	chlorpyrifos	☺	High		C	methomyl	☺	Lo	
	diazinon	●	---		P	esfenvalerate	☺	Lo	
	dimethoate	●	Lo		P	permethrin	☺	Lo	
	malathion	---	Lo		CH	endosulfan	---	Lo	
	methyl parathion	☺	Lo		B	Bacillus thuringiensis	---	Lo	
	phosmet	☺	High		O	abamectin	---	Lo	
					O	imidicloprid	---	Lo	
					O	phermones	---	---	
Apple Maggot (Major)	azinphos-methyl	☺	High		C	carbaryl	❍	Lo	No acceptable alternative pesticides for control of Apple Maggot. **Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance.
	chlorpyrifos	●	Lo		C	methomyl	❍	Lo	
	diazinon	❍	---		CH	endosulfan	---	Lo	
	dimethoate	☺	Lo		P	esfenvalerate	---	Lo	
	malathion	---	Lo		P	permethrin	---	Lo	
	methy parathion	☺	Lo						
	phosmet	☺	High						

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Post-Bloom									
Leafroller (Moderate)	azinphos-methyl	☺	High		C	carbaryl	●	---	Indications of leafroller resistance to **methomyl**. **Carbamate or Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance (already noted for esfenvalerate).. **Bacillus thuringiensis** efficacy is temperature dependent and requires multiple applications.
	chlorpyrifos	☺	High		C	methomyl	☺	Mod	
	diazinon	❍	---		P	esfenvalerate	☺	Lo	
	dimethoate	● - ☺	---		P	permethrin	☺	Lo	
	methyl parathion	☺	Lo		CH	endosulfan	---	Lo	
	phosmet	☺	High		I	tebufenozide	---	Lo	
					O	imidicloprid	---	Lo	
Aphid (Moderate)	azinphos-methyl	---	Mod		C	methomyl	❍	Mod	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance. **Esfenvalerate** and endosulfan do not provide adequate efficacy against aphids. **Imidicloprid** resistance can be expected without other effective OP alternatives. **Oil** efficacy is dependent upon suitable weather conditions and may cause phytotoxicity at temperatures below 40°F.
	chlorpyrifos	● - ☺	Mod		C	oxamyl	❍	Lo	
	dimethoate	● - ☺	Mod		P	esfenvalerate	●	Lo	
	malathion	---	Lo		P	permethrin	●	Lo	
	methyl parathion	● - ☺	---		CH	endosulfan	●	Mod	
	phosmet	---	Lo		O	clofentezine	---	Lo	
					O	imidacloprid	☺	Mod	
					O	petroleum oil	● - ☺	Lo	

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Post-Bloom									
Plum Curculio (Moderate)	azinphos-methyl	☺	High		C	carbaryl	●	Lo	OP's are the only effective option for controlling Plum Curculio. **Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance.
	chlorpyrifos	❍	Lo		C	methomyl	●	---	
	dimethoate	---	Lo		P	esfenvalerate	☺	Lo	
	methyl parathion	☺	Lo		P	permethrin	☺	Lo	
	phosmet	☺	High		O	imidicloprid	---	Lo	
Fruit/Bud Moth (Minor)	azinphos-methyl	---	High		C	carbaryl	---	Lo	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance. **Pheromones** are commercially unproven.
	chlorpyrifos	---	Lo		P	esfenvalerate	---	Lo	
	methyl partathion	---	Lo		P	permethrin	---	Lo	
	phosmet	---	High		O	pheromone	---	---	
Bug (Minor)	azinphos-methyl	---	High		C	methomyl	❍	Mod	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance.
	chlorpyrifos	---	Mod		C	oxamyl	❍	---	
	dimethoate	☺	---		p	esfenvalerate	☺	Lo	
	methyl parathion	●	---		p	permethrin	☺	---	
	phosmet	---	High		CH	endosulfan	●	Lo	
					O	formetanate hydrochloride			

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Post-Bloom									
Leafhopper (Minor)	azinphos-methyl	---	High		C	carbaryl	☺	Lo	**Pyrethroid** use will cause mite outbreaks as a result of disrupting biological control. In additon, mite outbreaks would entail more miticide applications with a high potential for development of resistance. **Imidicloprid** resistance can be expected without other effective OP alternatives.
	chlorpyrifos	---	Mod		C	methomyl	☺	High	
	dimethoate	●	Lo		C	oxamyl	☺	Lo	
	methyl parathion	---	Lo		P	esfenvalerate	❍	Lo	
	phosmet	---			P	permethrin	---	Mod	
					CH	endosulfan	●	Lo	
					O	formentate hydro.	☺	---	
					O	imidicloprid	☺	Mod	
					O	soap	❍	---	
Scale (Minor)	azinphos-methyl	---	Mod		C	carbaryl	---	Lo	**Oil** efficacy is dependent upon suitable weather conditions and may cause phytotoxicity at temperatures below 40°F.
	chlorpyrifos	☺	High		C	methomyl	---	Mod	
	diazinon	❍	---		O	oil	☺	---	
	methyl parathion	❍	Lo						
Borer (Minor)	chlorpyrifos	---	High		C	methomyl	---	Lo	**Pyrethroids** may flare many pests by killing predators and beneficials. Pyrethroid use against Fruitworm would lead to increased miticide applications with potential for development of resistance.
	methyl parathion	---	High		P	esfenvalerate	---	Lo	
	phosmet	---	Lo		P	permethrin	---	High	
					CH	endosulfan	---	Lo	

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide

Site: Apples
Region: North Central

Pest	Organophosphate	Efficacy	Mkt		Class	Alt. Pesticide List	Efficacy	Mkt	Constraints of Alternatives
Timing: Post-Bloom									
Leafminer (Minor)	azinphos-methyl	---	High		C	methomyl	❍ - ☺	High	**Pyrethroids** may flare many pests by killing predators and beneficials. Pyrethroid use against Fruitworm would lead to increased miticide applications with potential for development of resistance. Efficacy of alternative pesticides vary in relation to target species.
	chlorpyrifos	---	Mod		C	oxamyl	☺	Lo	
	dimethoate	●	Lo		P	esfenvalerate	● - ☺	Mod	
					P	permethrin	● - ☺	Mod	
					CH	endosulfan	●	Mod	
					O	formentate hydro.	❍	---	
					O	imidicloprid	☺	Mod	
Fruitworm (Minor)	azinphos-methyl	---	High		C	carbaryl	---	Lo	**Pyrethroids** may flare many pests by killing predators and beneficials. Pyrethroid use against Fruitworm would lead to increased miticide applications with potential for development of resistance.
	chlorpyrifos	☺	High		C	methomyl	❍	Lo	
	diazinon	●	---		P	esfenvalerate	☺	Lo	
	methyl parathion	●	Lo		P	permethrin	☺	Mod	
	phosmet	---	High						

ADDITIONAL INFORMATION:

Apple production in the North Central Region (Michigan and Ohio) accounts for 13.6% of total acreage and 7.9% of production for the US. OP usage during the Post-Bloom period in the North Central Region is 80.9% of all pesticide usage.

Apple Maggot, Plum Curculio, and Codling Moth are direct pests (fruit feeders) and the most important pests controlled by OP's in the North Central Region. Failure to control these 3 pests would have a 70-90% impact on apple production in this region. Use of Pyrethroids in place of OP's to control these pests will flare many secondary pest populations by killing predators and beneficials.

Phermone disruption of mating is a weak alternative to OP's but only in instances where field populations are low or have been previously chemically supressed.

For Apple Maggot, Plum Curculio, secondary and indirect pests there are no alternative chemical controls available at this time.

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide

Site: Apples
Region: North Central

SOURCES:

1. Proprietary EPA market share information.
2. U.S. Apple QUA+ - Michigan. 1997.
3. QUA+ Michigan Apple Commission. 1997
4. 1997 Fruit Spraying Calendar for Commercial Fruit Growers. 1997. Bulletin E-154. Michigan State University Extension.
5. The All-Crop, Quick Reference Insect Control Guide. 1997. Meister Publishing Company.
6. Label Use Information System (LUIS) Version 5.0, EPA.

Date: 01/29/99

Pest Importance: Major = 20+% of all OP usage on pest; Moderate = 5-20% of all OP usage on pest; Minor = <5% of all OP usage on pest
Efficacy Rating: Excellent = ☺ Good = ❍ Fair = ● --- = Not rated for efficacy in state recs.
Market Share: High = 20+% OP usage on pest; Med = 5-20% of all usage on pest; Lo = <5% of all usage on pest; --- = not available for 1994-96.
Insecticides: C = Carbamates; P = Pyrethroids; CH = Chlorinated Hydrocarbons; IGR = Insect Growth Regulators; B = Biological; O = Other pesticide